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Understanding of First Aid for Ocular Trauma Among Medical Students: A Cross-Sectional Study

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Abstract **Background:** Ocular trauma is a leading cause of vision impairment, yet medical students often lack comprehensive training in ocular first aid. This study evaluates the knowledge and preparedness of medical students regarding ocular trauma causes, symptoms, and first aid practices. **Purpose:** To assess medical students' awareness of ocular trauma, identify knowledge gaps, and evaluate their preparedness to manage ocular emergencies. **Methods:** A cross-sectional survey was conducted on 455 medical students from various academic years. Participants were asked about their awareness of ocular trauma causes, symptoms requiring immediate medical attention, and first aid practices. Data were analysed to identify trends and knowledge gaps. **Results:** The sample had nearly equal gender distribution (50.55% males, 49.45% females), with most students aged 18-22 years (60%) and in their fourth or internship year (56.49%). Awareness was high for chemical exposure (56.70%) and foreign bodies (53.41%) but lower for road traffic accidents (29.89%) and sports injuries (24.61%). While 65.27% recognized vision loss as urgent, fewer identified eye movement limitation (32.09%) and pupil changes (36.70%). Only 21.54% had specific ocular first aid training, and 45.94% felt unprepared. Misconceptions were common, such as removing embedded objects (22.42%). Workshops (63.3%) and hands-on simulations were preferred for improving preparedness. **Conclusion:** The study reveals significant gaps in medical students' knowledge and preparedness regarding ocular trauma management. Misconceptions and insufficient training highlight the need for improved ocular trauma education, including targeted curriculum revisions and hands-on training to enhance student confidence and preparedness.

Key Words First aid in ocular trauma; foreign body; blunt ocular trauma; chemical exposure, medical curriculum; training in first aid; vision loss

INTRODUCTION

Ocular trauma represents a diverse spectrum of eye injuries that constitute a leading cause of visual impairment and blindness globally [1-4]. Ocular trauma accounts for up to 40% of monocular blindness worldwide, with a disproportionate burden in the younger, economically productive age groups [5-7]. These injuries significantly impact individuals' quality of life and impose a considerable socioeconomic burden, particularly in developing countries [8-10]

To standardize diagnosis and facilitate research, the Birmingham Eye Trauma Terminology System (BETTS) classifies ocular injuries into two major categories: open-globe and closed-globe injuries. Open-globe injuries include rupture, penetration, perforation, and intraocular foreign body (IOFB), while closed-globe injuries encompass contusion and lamellar laceration [11]. This classification is critical for effective communication among healthcare providers and for guiding appropriate management strategies.

Despite being largely preventable, ocular trauma remains underreported and poorly addressed in many healthcare systems. Inadequate protective measures, lack of public awareness, and delayed medical intervention contribute to poor outcomes [12-13]. Common causes include road traffic accidents, workplace injuries, sports-related trauma, domestic accidents, and assaults, with the highest incidence observed in children and young adult males [14-16].

Timely and appropriate first aid plays a pivotal role in mitigating the severity of injury and preserving vision. For instance, immediate irrigation of the eye following chemical exposure is a well-established intervention that significantly improves outcomes yet is often delayed or omitted due to lack of awareness [17]. Similarly, shielding the eye after blunt or penetrating trauma can prevent further damage during transportation to medical facilities [18]. Therefore, pre-hospital care and initial response are as crucial as in-hospital treatment in determining prognosis.

Several studies emphasize the importance of first responder and public education in ocular trauma. A survey conducted in Turkey revealed that a substantial percentage of patients with chemical injuries presented late, with improper first aid being a key factor in the development of complications [19]. Moreover, healthcare providers, particularly general practitioners and emergency department personnel, are often the first point of contact and must be equipped with the necessary skills to administer immediate care and provide public education.

The role of medical students in trauma response and community education is increasingly recognized. However, knowledge gaps persist. A study indicates that less than 50% medical students could correctly identify the appropriate first aid for common ocular injuries [20].

In Saudi Arabia, limited research has explored medical students' awareness and preparedness regarding ocular trauma. Northern Border University (NBU), situated in a region where trauma cases are not uncommon, offers a strategic setting to assess and enhance medical education. Evaluating NBU students' understanding of ocular trauma first aid can reveal critical gaps, guiding the development of targeted educational interventions that can ultimately improve emergency response and patient outcomes.

This study, therefore, aims to assess the level of knowledge and preparedness among medical students at Northern Border University regarding first aid in ocular trauma. By doing so, it addresses a notable gap in literature and contributes to the broader effort to reduce preventable vision loss through improved medical training and public health strategies.

METHODS

Study Setting and Design

From July 05,2024 to January 05, 2025, this cross-sectional descriptive survey was conducted among Northern Border University students in Arar city of Saudi Arabia.

Sample Size and Sampling Method

Convenient sampling technique was employed and the minimal sample size for the study (386) was calculated according to the equation:

$$\text{Sample size} = \frac{Z_{1-\alpha/2}{}^2 \, P(1-P)}{d^2}$$

- Z1-α/2: is the standard normal variation at 5% type 1 error ($p<0.05$); it is 1.96.
- P: The expected proportion based on previous studies.
- D: The absolute error (0.05)

The expected proportion was considered 50% since there is no previous study in the Northern Border region, and to maximize the sample size."

Assessment Tool

Awareness levels were evaluated through a pre-designed bilingual questionnaire (Arabic and English). The questionnaire began with an introductory section, followed by demographic questions. Participants' knowledge of ocular first aid was measured using seven questions, while five additional questions assessed their ability to apply this knowledge in practice. The final section gathered information on participants' preferred resources and training methods for enhancing their preparedness in ocular first aid. The questionnaire was distributed both online via platforms like Google Forms and university portals and in person at university campuses.

Inclusion and Exclusion Criteria

All medical students in the NBU who agreed to participate in the study were included and all non-medical students or medical students outside NBU were.

Statistical Analysis

STATA/SE version 11.2 for Windows (STATA Corporation, College Station, Texas) was used for data management and analysis. The data were described in terms of frequency and percentage regarding categorical data and mean ± Standard Deviation (SD) regarding quantitative data. Shapiro-Wilk W test was used to examine the distribution of knowledge scores. Comparisons of students' ocular first aid practice levels between the different study groups were carried out using the Mann-Whitney Test (Z). Statistical significance was considered at $P<0.05$.

Ethical Approval

Decision number 104/24/H issued by Bioethics Committee at NBU.

RESULTS

The study included 455 students, with a nearly equal gender distribution (50.55% males and 49.45% females). The majority (60.00%) were between 18-22 years old, while 40.00% were 23-27 years old. Most participants were in their fourth (33.63%) or internship year (22.86%), indicating that a significant portion had already undergone substantial clinical training. The demographic characteristics of all participants are given in Table 1.

Students demonstrated varying levels of awareness regarding ocular trauma causes, symptoms, and first aid measures. Chemical exposure (56.70%), foreign bodies

Table 1: Age, Gender, and Academic Year Distribution of Students (n = 455)

Variable		Number	Percentage
Age (years)	18-22	273	60.00
	23-27	182	40.00
Gender	Male	230	50.55
	Female	225	49.45
Academic Year	First Year	12	2.64
	Second Year	44	9.67
	Third Year	30	6.59
	Fourth Year	153	33.63
	Fifth Year	52	11.43
	Sixth Year	60	13.19
	Internship	104	22.86

Table 2: Students' Knowledge of Ocular Trauma (n = 455)

Variable		No.	%
What is/are the common cause (s) of ocular trauma?	Chemical exposure to the eye	258	56.70
	Blunt injury	223	49.01
	Foreign body	243	53.41
	Sporting events	112	24.61
	Road traffic accidents	136	29.89
Which symptom (s) indicate a serious ocular injury needing immediate medical attention?	Severe pain	266	58.46
	Loss of vision	297	65.27
	Blood in the eye	228	50.11
	Foreign body in the eye	170	37.36
	Light sensitivity	109	23.96
	Change in pupil size or shape	167	36.70
	Swelling and darkness around the eye	134	29.45
	Limitation in eye movements	146	32.09
	Torn eye lid(s)	90	19.78
What should you do if someone has a scratch in his eye?	Allow him to rub the eye	60	13.19
	Encourage him to blink more frequently	78	17.14
	Clean the eye with cotton or tissue	128	28.13
	Patch the eye and send refer to the hospital	272	59.78
	Apply antibiotic drops or ointment	99	21.76
	I don't know	66	14.50
What should you do if someone has a foreign body (FB) in his eye?	Flush the eye with water or saline	197	43.30
	Try to remove FB manually	108	23.74
	Patch the eye and refer to the hospital	188	41.32
	Apply antibiotic drops or ointment	82	18.02
	I don't know	78	17.14
What should be done in case of a penetrating eye injury?	Remove the object immediately	102	22.42
	Apply pressure patch to the eye	80	17.58
	Protect the eye with a shield and refer to hospital	277	60.88
What should be done if a person presents with a chemical splash in his eye(s)?	Flush the eye with water or saline	269	59.12
	Patch the eye and refer to hospital	34	7.47
	Apply antibiotic drops or ointment.	46	10.11
	Wait for symptoms to develop	28	6.15
	I don't know	78	17.14
What should you do in case of a blow to the eye?	Apply cold compress	164	36.04
	Apply pressure on the eye	56	12.31
	Apply warm compress	88	19.34
	Seeking medical help (hospital or a doctor)	164	36.04
	I don't know	119	26.15

Note: *More than one answer was allowed

(53.41%), and blunt trauma (49.01%) were the most recognized causes. Notably, awareness of ocular trauma from road traffic accidents (29.89%) and sporting events (24.61%) was lower. Regarding symptoms requiring immediate medical attention, loss of vision (65.27%), severe pain (58.46%), and blood in the eye (50.11%) were the most recognized. However, important indicators such as limitation in eye movement (32.09%) and changes in pupil size (36.70%) were less identified.

The study also assessed students' knowledge of appropriate first aid responses. The majority correctly identified need to patch the eye and refer to a hospital for corneal abrasions (59.78%) and penetrating eye injuries (60.88%). However, misconceptions were evident, such as 22.42% believing that an embedded object should be removed immediately. Additionally, 17.14% did not know how to handle chemical splashes Table 2.

Table 3: Students' Practical Application of Ocular First Aid Knowledge (n = 455)

Variable		No	%
Have you received any kind of training in first aid?	Yes	201	44.18
	No	254	55.82
Have you received any specific training in ocular first aid?	Yes	98	21.54
	No	357	78.46
How confident are you in providing first aid for ocular trauma?	Very confident	50	10.99
	Confident	84	18.46
	Not very confident	152	33.41
	Not confident at all	57	12.53
	Neutral	112	24.62
Do you believe the current medical curriculum provides adequate training in first aid for ocular trauma?	Yes	142	31.21
	No	116	25.49
	Not sure	197	43.30
How important do you believe it is for medical students to be trained in first aid for ocular trauma?	Extremely important	174	38.24
	Very important	141	30.99
	Moderately important	72	15.82
	Slightly important	26	5.71
	Not important	42	9.23
Total score	Mean ±SD	1.96±139	

Note: Statistical analysis showed no significant difference in first aid practices between different age groups (p = 0.43) or genders (p = 0.90)

Table 4: Variations in Students' Ocular First Aid Practices by Age and Gender (n = 455)

Variable		No.	Practice level Mean ±SD %	Mann-Whitney test statistic (Z)	p
Age (years)	18-22	273	1.93 ±1.45	0.79	0.43
	23-27	182	1.99±1.30		
Gender	Male	230	1.96±1.37	0.13	0.90
	Female	225	1.95±1.42		

Note: Statistical significance was considered at p<0.05

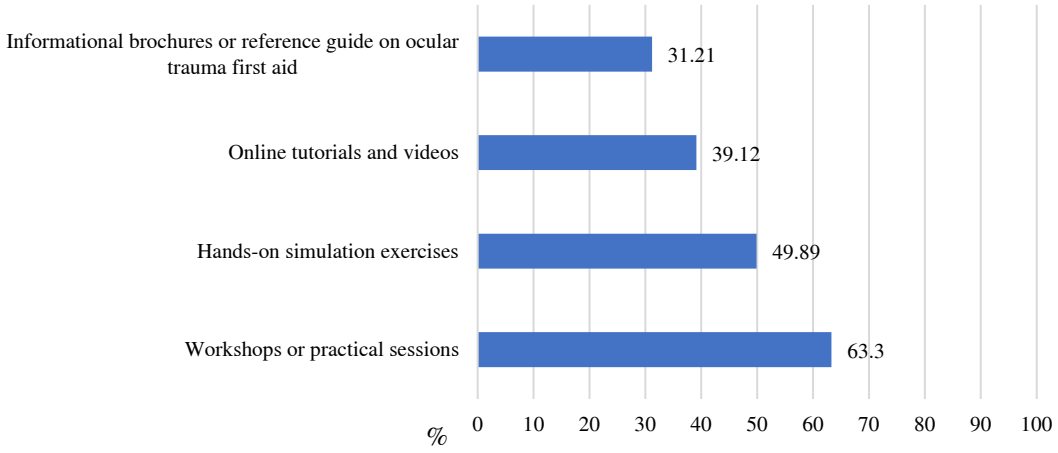

Figure 1: Preferred Strategy for Improving Ocular First Aid Preparedness (n = 455)

While 44.18% of students had received general first aid training, only 21.54% had specific training in ocular first aid. Confidence levels in managing ocular trauma were low, with only 29.45% expressing confidence (10.99% very confident, 18.46% confident), whereas 45.94% felt unprepared (33.41% not very confident, 12.53% not confident at all).

Only 31.21% of students believed the current curriculum adequately covers ocular trauma first aid, while 43.30% were unsure. Encouragingly, 38.24% rated training in ocular first aid as extremely important, with an additional 30.99% considering it very important. Table 3.

Regarding measures to improve ocular first aid preparedness, participants considered workshops and practical sessions (63.3%) the most beneficial, followed by hands-on simulation exercises (49.9%) (Figure 1).

DISCUSSION

This study evaluated the knowledge, attitudes, and practices related to ocular trauma first aid among medical students at Northern Border University (NBU). Despite a relatively balanced distribution of participants by gender and academic year, the overall knowledge and confidence levels were suboptimal. While many students correctly identified major causes and emergency signs of ocular trauma, misconceptions were evident, particularly in the management of chemical injuries and penetrating trauma. These findings are consistent with previous literature and offer important insights into gaps in education and training.

In a similar cross-sectional study [21] involving primary school teachers in Qassim Province, only 20.6% had received prior training in ocular trauma first aid—comparable to the 21.54% in our cohort. Although teachers are not expected to have clinical expertise, their low awareness highlights the general lack of ocular first aid training even among educated segments of the population.

In our study, only 59.12% of students knew that immediate flushing is the correct first aid response to chemical eye injuries. This is particularly concerning given that chemical injuries are among the most time-sensitive ocular emergencies. According to studies [22-23] delays or improper responses to chemical injuries can result in irreversible ocular damage, reinforcing the importance of widespread first aid education.

The pattern of recognition regarding symptoms of serious ocular injury, such as vision loss and severe pain, was relatively better (65.27% and 58.46%, respectively). However, only 36.70% recognized pupil changes and 32.09% were aware of limited eye movement as red flags. This limited awareness reflects the findings from study conducted on medical students at King Abdulaziz University [24]. They too found that while basic knowledge was acceptable, more subtle clinical signs were frequently under-recognized.

Furthermore, our results mirror to a survey from the general population in the Asser Region [25]. They observed that although public awareness of the importance of early management was high (77.4%), only 40% had accurate practical knowledge, and the majority believed that foreign objects should be manually removed. This suggests that certain misconceptions persist across both the general population and future healthcare professionals.

Interestingly, confidence levels among NBU students were low, with only 29.45% expressing any confidence in managing ocular trauma. This finding is consistent with a study from Saudi Arabia [24] where university students also reported low levels of confidence, particularly in practical scenarios. This is likely due to limited hands-on training, which most participants in our study identified as a major shortcoming.

Regarding educational strategies, 63.3% of our respondents favored workshops and 49.9% preferred simulation-based training to improve preparedness. These preferences align with global best practices advocated by Shah *et al.* [23], who highlighted simulation-based educational interventions as highly effective in improving eye injury prevention and emergency response skills.

Notably, only 31.21% of students believed their curriculum adequately covers ocular trauma first aid, and 43.30% were unsure, indicating a need for curriculum reform. Incorporating structured ocular trauma modules and simulation-based training may not only improve knowledge but also enhance clinical confidence.

Finally, statistical analysis showed no significant difference in first aid knowledge or practice based on gender or age, which is encouraging as it suggests a uniform baseline. However, targeted interventions are still needed across all academic years, particularly early in the curriculum, to ensure longitudinal competency development.

Strengths

The study included a large sample size (455 students) with a nearly equal gender distribution and varied academic years, providing a broad and representative understanding of the students' levels of awareness and preparedness in managing ocular trauma.

The study effectively highlighted specific gaps in knowledge regarding ocular trauma causes, symptoms, and first aid practices. The findings identify misconceptions and areas of improvement, which could guide curriculum adjustments and targeted training programs.

Limitations

The study is cross-sectional, meaning it captures students' knowledge and preparedness at a single point in time. Without longitudinal data or follow-up assessments, it is difficult to track the impact of training interventions or to assess the retention and application of knowledge over time.

CONCLUSION

This study reveals notable gaps in medical students' knowledge, confidence, and preparedness for managing ocular trauma. While urgent symptoms like vision loss were commonly recognized, understanding of less obvious signs such as restricted eye movement and pupil changes was limited. Awareness of trauma sources like road accidents and sports was also lacking.

Confidence in handling ocular injuries was low, primarily due to insufficient ocular-specific first aid training. Though general first aid was more familiar, misconceptions such as removing embedded objects or applying pressure to the eye persisted.

Given the inconsistency in curricular coverage and the strong interest among students, integrating structured, evidence-based training through workshops and simulations is recommended. Future research should assess the effectiveness of such interventions in enhancing students' competency and readiness for real-world ocular emergencies.

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